THURBER ENGINEERING LTD.

ALBERTA TRANSPORTATION GEOHAZARD ASSESSMENT PROGRAM
PEACE REGION – PEACE-HIGH LEVEL
2009 INSPECTION

Site Number	Location	Name	Hwy	km
PH33	Judah Hill	Judah Trunk	744:04	58.90
Legal Description		**UTM Co-ordinates**		
SE¼ 29-083-21 W5M		11V E 482906	N 6230669	

	Date	PF	CF	Total
Previous Inspection:	02-Jun-2008	5	2	10
Current Inspection:	26-May-2009	5	2	10
Road AADT:	2250		**Year:**	2007
Inspected By:	Simon Cullum-Kenyon Roger Skirrow Neil Kjelland		Don Proudfoot Ed Szmata	
Report Attachments:	☑ Photographs ☑ Plans		☐ Maintenance Items	

Primary Site Issue:	Failure of joints on band-coupled 450 mm diameter corrugated plastic pipe down-drain installed at km 58.9. Cracking and pavement distress on downslope shoulder of road.	
Dimensions:	Cracking and pavement distress extend from shoulder to the middle of the south-bound lane, along roughly 90 m length of road north of the down drain.	
Maintenance:	No maintenance conducted since 2008.	
Observations:	**Description**	**Worsened?**
☑ Pavement Distress	Longitudinal cracking and occasional transverse cracks along 90 m length of road north of the trunk drain. Longitudinal cracks extend from the downslope shoulder into the middle of the south-bound lane (Photos 4 and 5).	☑
☑ Slope Movement	Small skin failure has occurred on the cutslope above the upslope ditch (Photo 6) and partially blocks the ditch.	☑
☐ Erosion		☐
☐ Seepage		☐
☑ Bridge/Culvert Distress	There is debris clogging the inlet to the down-drain (Photo 1). The connection between the culvert under the road and the down-drain has separated (Photo 2). All of the couplings on the corrugated plastic pipe down-drain have failed,	☐

	and erosion is occurring under the pipe (Photo	
☐ Other		☐

Instrumentation:

SI98-6i	Inclinometer installed at the toe of the slope, north of the drain. Minor movement in A-direction, with some surface creep. Total cumulative in B direction may be as high as 50 mm. No distinct shear planes identified.
SI98-7i	Inclinometer installed at the toe of the slope, north of the drain. No distinct shear planes identified. Cumulative deflection in A-direction of approximately 15 mm, and 25 mm in B-direction.
Piezometers PN98-6, PN98-6a PN98-7 PN98-7a	Generally show little historic variation – trend is relatively flat. Some increases in PN98-7 and PN98-6a. May pick up more variation if read more frequently (eg. datalogging of replacement VW or standpipe piezometers), in response to rain and/or snow events.

Assessment:

Further skin failures should be expected in the steep cut slopes above the road – the maintenance burden does not appear very great at this stage.
The trunk down-drain should be repaired as a matter of urgency to prevent severe erosion on the slope. Given that it includes drainage along the road up to the Lookout slide, a larger pipe may be required.
Cracking and pavement distress on the downslope shoulder might indicate slope stability problems.

Recommendations:	**Cost**
Check flow capacity required in down-drain (assess drainage area) as pre-requisite for repair (to determine pipe size).	Investigation
Install additional slope indicator casings on downslope shoulder of road to allow assessment of movement and provide information for design of repair measures, should this become necessary.	Investigation
Flatten/re-grade slopes around drain inlet, remove debris and re-armour (class 1M rip rap)	Maintenance
As a short-term fix, repair band couplings on down-drain using e.g. adhesive wrap or similar.	Maintenance
Remove slide debris from upslope ditch north of the drain inlet.	Maintenance
Replace corrugated plastic down drain with welded HDPE pipe with appropriate flow capacity. Repair connection to culvert under road.	$ 150,000

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PEACE REGION – PEACE-HIGH LEVEL
2009 INSPECTION

Site Number	Location	Name	Hwy	km
PH33	Judah Hill	CNR Slide	744:04	59.60
Legal Description		**UTM Co-ordinates**		
NE¼ 29-083-21 W5M		11V E 482645	N 6231308	

	Date	PF	CF	Total
Previous Inspection:	02-Jun-2008	13	4	52
Current Inspection:	26-May-2009	13	4	52
Road AADT:	2250		**Year:**	2007
Inspected By:	Simon Cullum-Kenyon Roger Skirrow Neil Kjelland		Don Proudfoot Ed Szmata	
Report Attachments:	☑ Photographs ☑ Plans		☐ Maintenance Items	

Primary Site Issue:	Two rotational slides, one above the other, with the toe being eroded at the Heart River. Slide movement apparently occurring over an eroded bedrock surface, above river level. Crest of slide(s) has previously affected the road and rail line near the level crossing. Pile walls installed to protect the road and rail line. Rip rap installed to protect the toe of the slope has been submerged by sediment in the Heart River.	
Dimensions:	80 m wide, 110 m long (plan view). Slide plane is probably 15 m to 20 m deep.	
Maintenance:	No maintenance since 2008.	
Observations:	**Description**	**Worsened?**
☑ Pavement Distress	Minor pavement distress and erosion of the west (downslope) shoulder of the road (Photos 7 and 8).	☑
☑ Slope Movement	Significant movement of failed material at the toe of the landslide – movement visible during inspection (Photo 12). No obvious retrogression of backscarp since 2008 (Photo 11).	☑
☑ Erosion	Erosion along the road shoulder to the south of the pile wall (Photo 8) – worsened since 2008. Heart River is eroding failed material at the toe of the slope. River has changed course after submerging the rip rap that was designed to keep it away from the toe of the slope	☑

	(Photo 13). River is also eroding rock exposed along the toe of the slope where landslide debris has been removed (Photo 12).	
☐ Seepage		☐
☑ Bridge/Culvert Distress	Inlet to the CNR Trunk is clogged with debris (Photo 9). Band couplings along the CNR Trunk are beginning to fail – noted in previous years.	☑
☑ Other	Parging between the piles on the CNR retaining wall has spalled locally (noted in previous years – has not worsened significantly) – see Photo 10.	☐

Instrumentation:

No instrumentation installed at this site.

Assessment:

Movement at the toe of the CNR slide is continuing, worsened by erosion of failed material at the toe of the slide. Erosion at the toe of the slope, which started in 2007, is expected to continue, with consequent further slide movement and retrogression of the backscarp towards the rail line and road. The pile wall along Hwy 744 was drilled to 20 m depth, and terminated above the expected rupture surface, so would be vulnerable to loss of toe support.

Recommendations:	**Cost**
Install mesh (welded wire or similar), anchored to the piles (and into the soil if possible) using Hilti anchors, for example, at areas of spalled parging. Place new parging to cover the mesh.	Maintenance
Remove debris from CNR Trunk down-drain. Repair band couplings on drain that are failed and appear to be leaking.	Maintenance
Install two slope indicator casings to EL. 332 (or lower to ensure at least 3 m embedment into sandstone below slickensided claystone / clay shale) between slide backscarp and pile wall. Log test holes to provide geotechnical information for design of possible tied-back pile wall to support current CNR Trunk wall. Install vibrating wire piezometers with data loggers in the sandstone, slickensided claystone / slay shale and clay till units at both inclinometer locations.	Investigation
Establish survey network around the pile wall, including benchmarks on 'stable' ground, and control points on the top and bottom of the wall. Conduct regular surveys every 1 – 2 years to detect movement / deflection of the wall, check for the length of exposed wall and movement of the ground around the wall.	Investigation
Assess the stability of the wall and ability to resist overturning based on the length of exposed wall and current ground anchorages. Assess the need for a toe support wall.	Investigation

Options to limit erosion by the Heart River at the toe of the slope should be assessed – this may require a review of river hydraulics. Mid-term to long-term repair options might include installation of a secant pile wall near the base of the slope. A shorter wall could be constructed nearer the toe of the existing pile wall at reduced cost. River training works such as rock vanes may be required in support of other repair options, or to limit further slope movement.	Investigation $ 3 million to $ 5 million $ 300,000

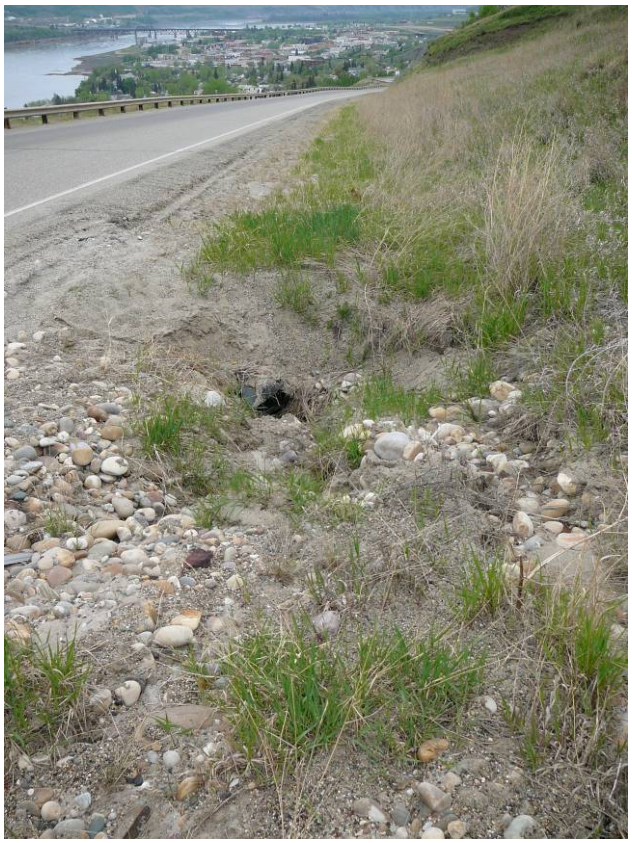


Photo 1.
Inlet for the Judah Trunk down drain. The inlet is clogged with debris and should be repaired.

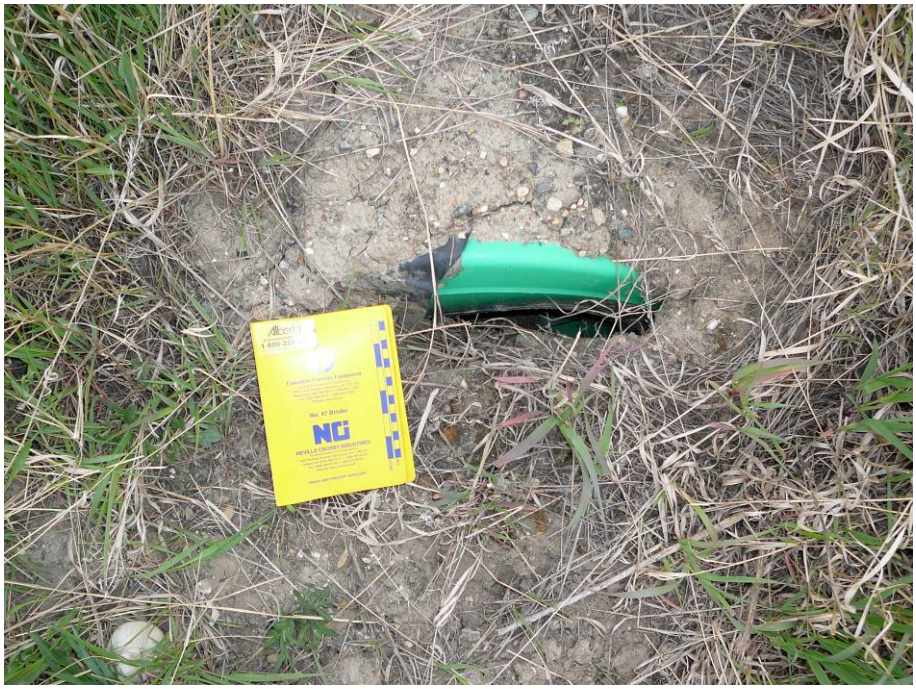


Photo 2.
Connection between the culvert and the down drain has failed, and should be repaired.

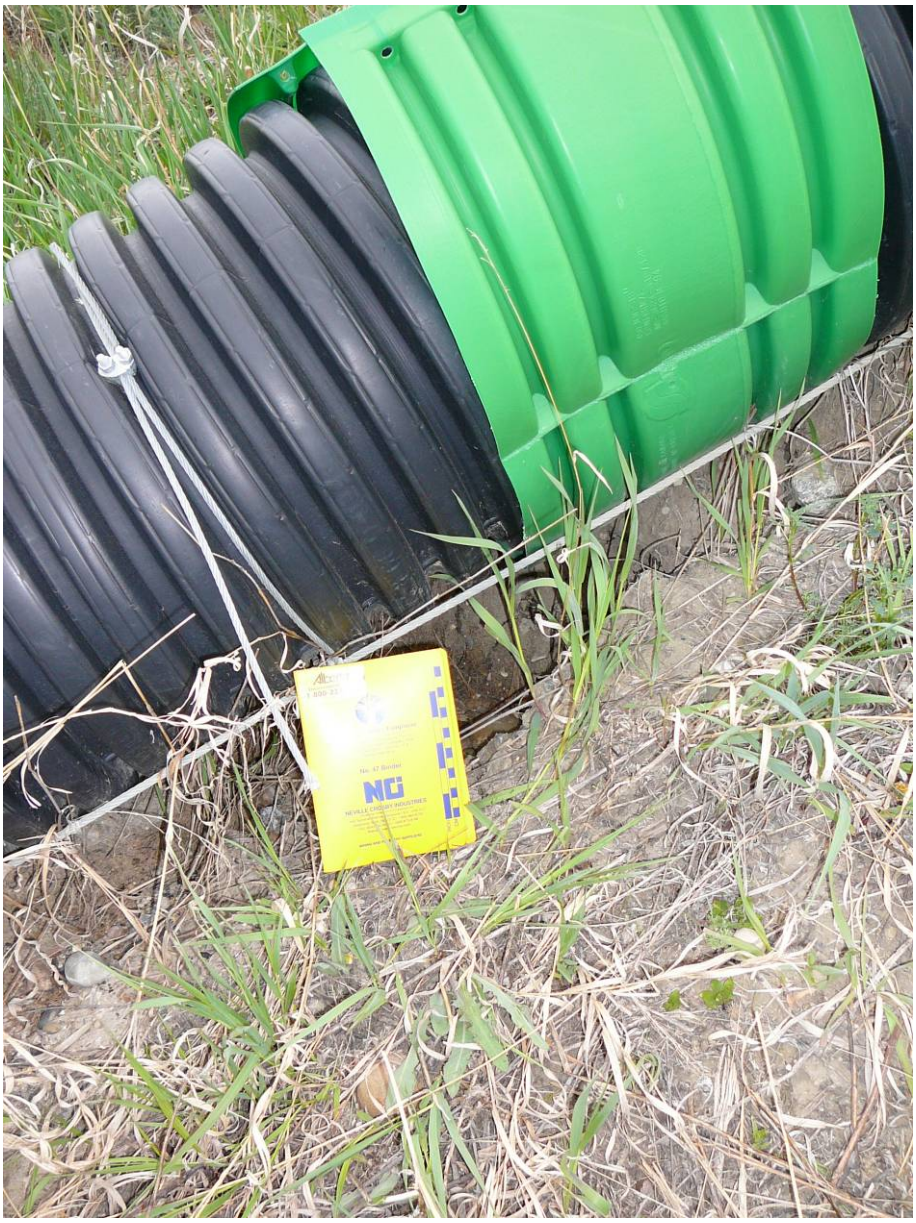


Photo 3.
All of the band couplings on the Judah Trunk down drain have failed. At the uppermost band coupling, erosion under the drain has worsened.

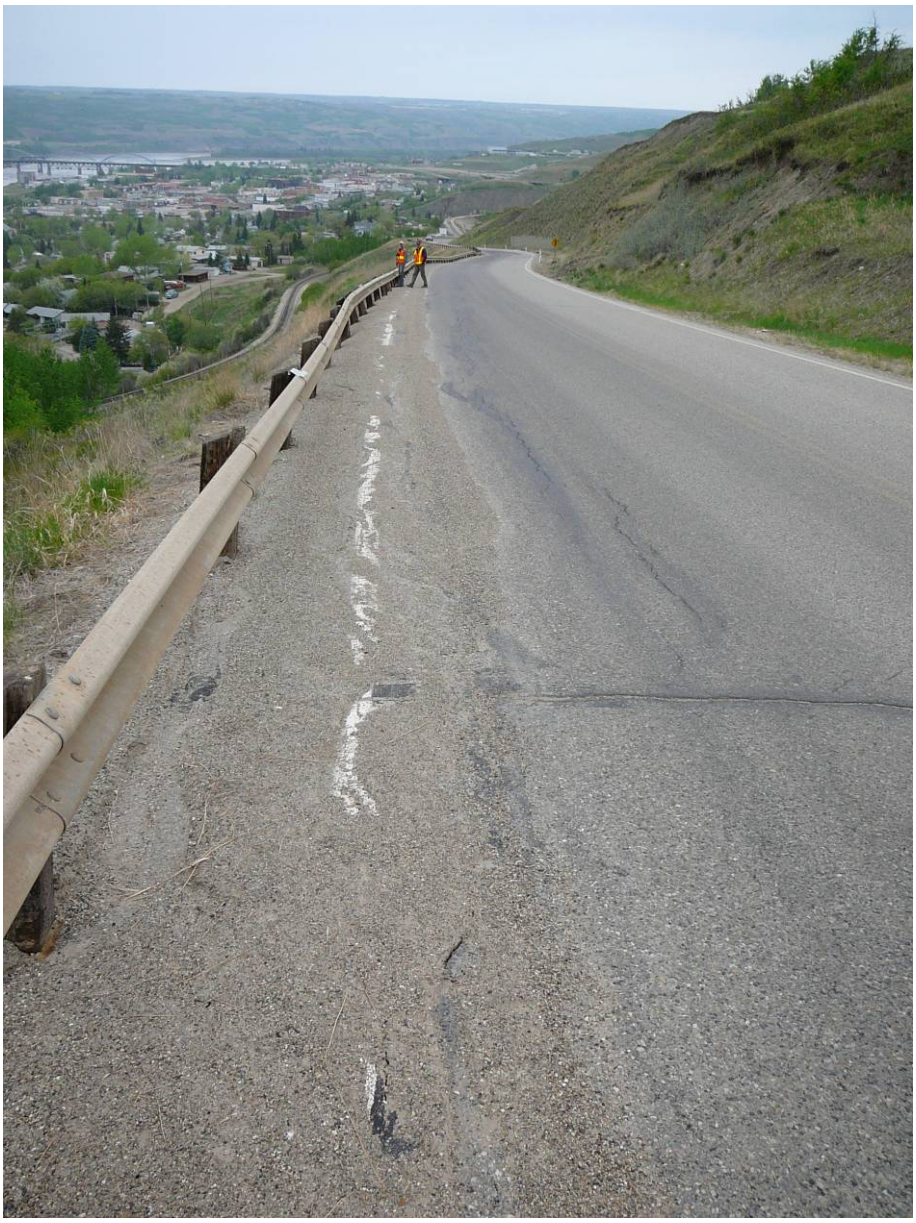
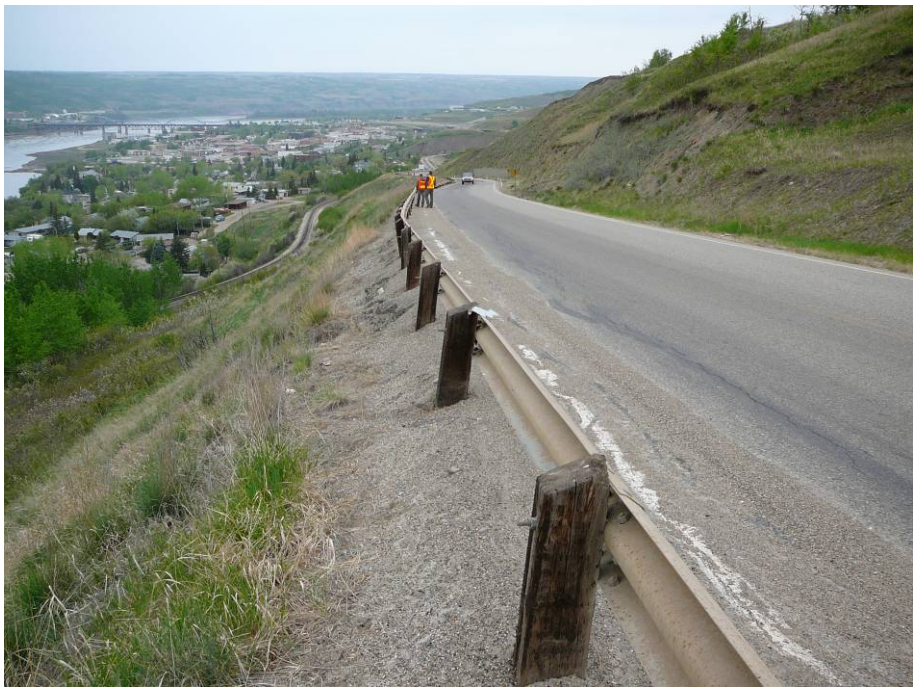
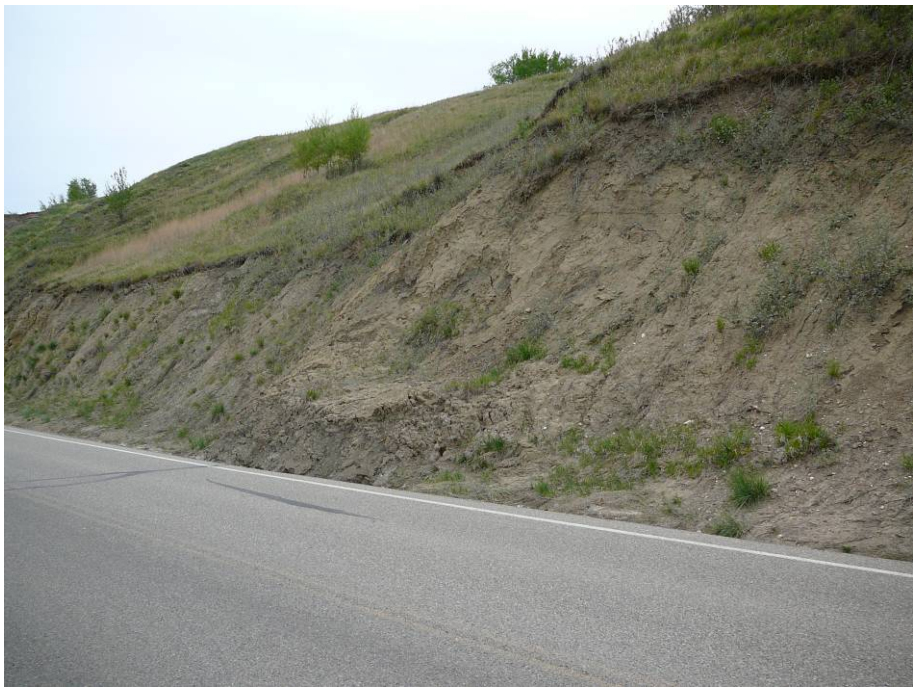
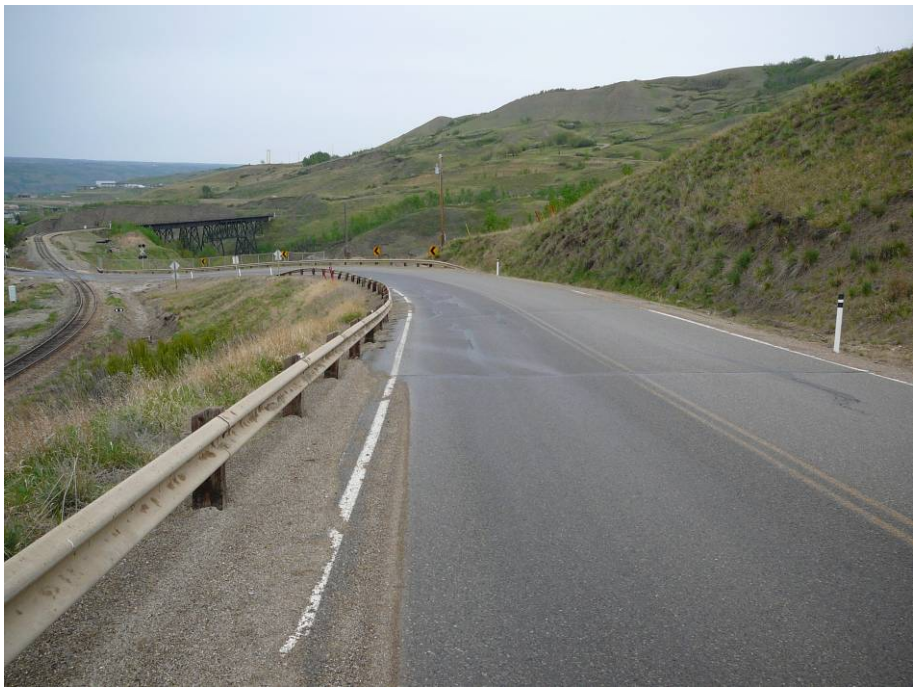
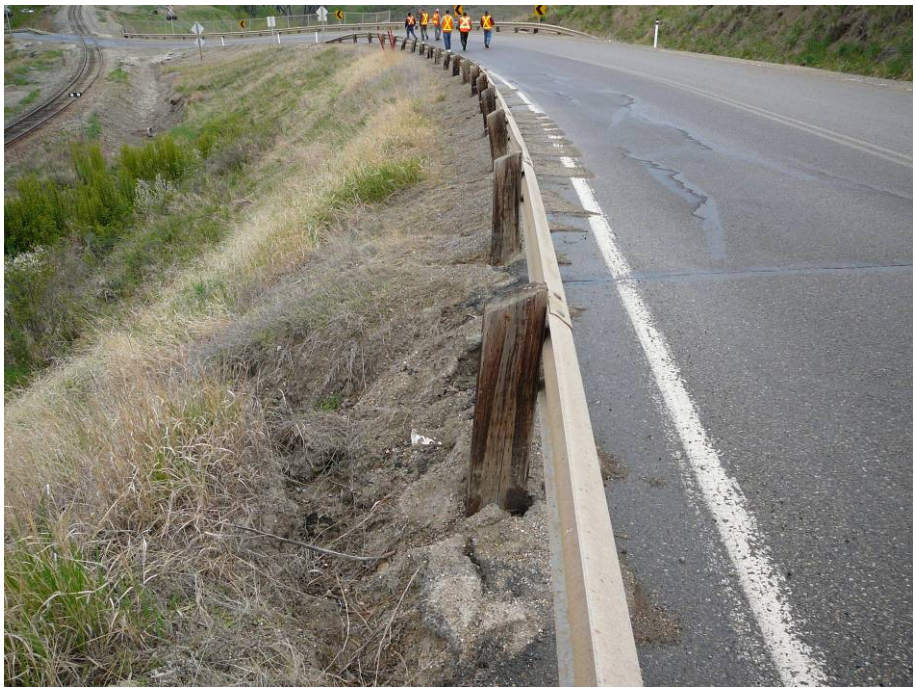
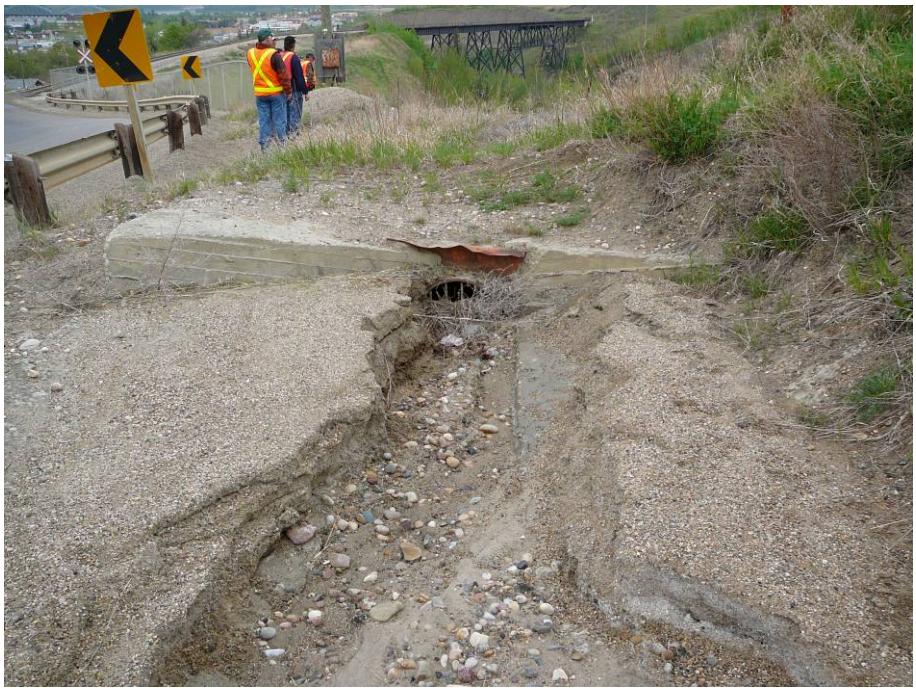
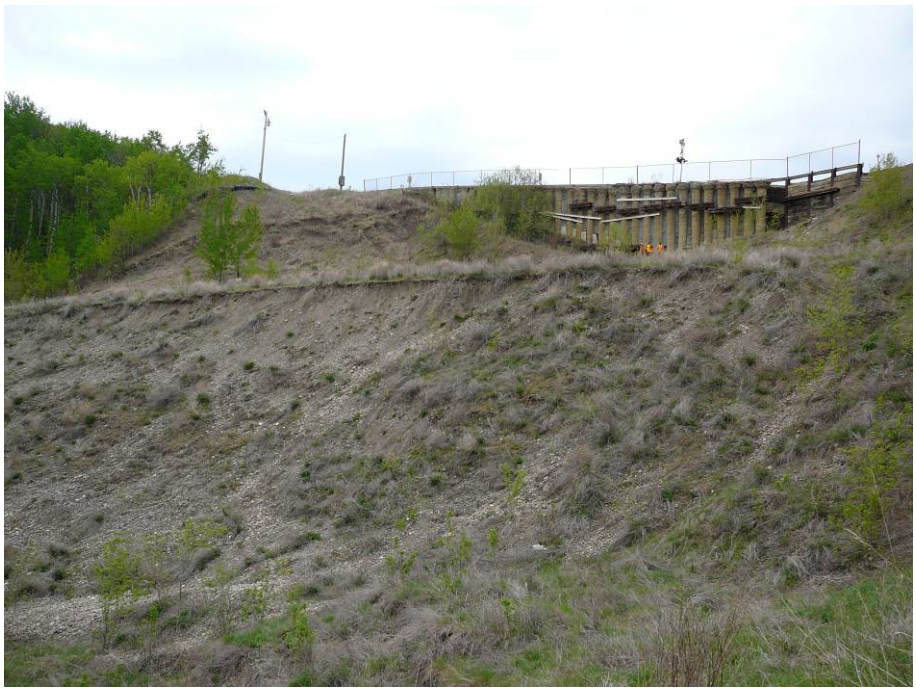
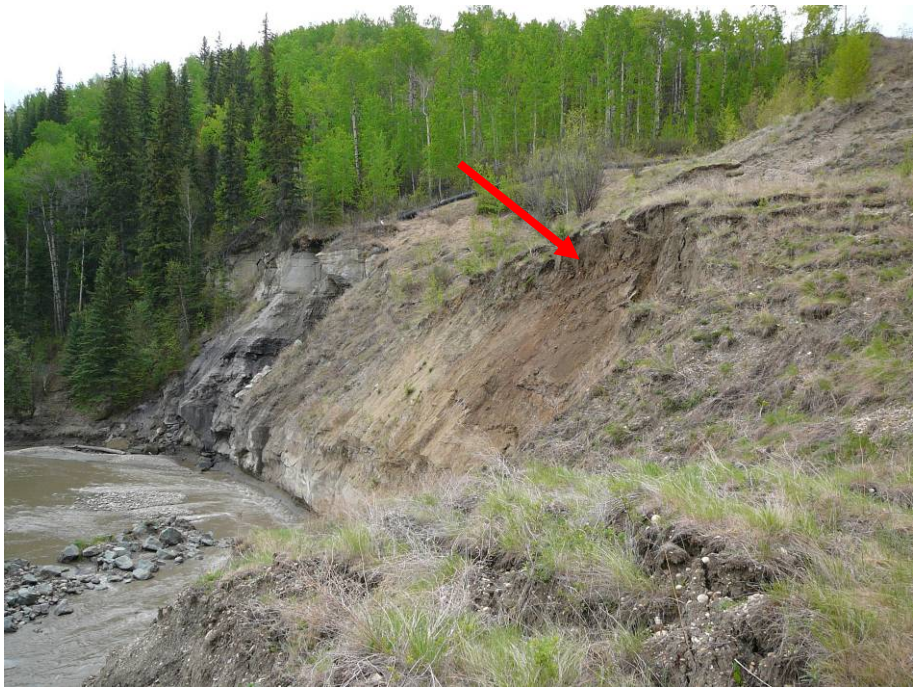


Photo 4.
Cracking along the downslope road shoulder has worsened since 2008.

	**Photo 5.** Cracking in the road and erosion / sloughing of the road shoulder, north of km 59.
	**Photo 6.** New skin failure in the upslope road cut. The failed material partially blocks the ditch and should be removed.

	**Photo 7.** Some cracking in the road on the inside of the bend on the approach to the CNR crossing.
	**Photo 8.** Erosion on the road shoulder due to drainage off the road. Also note the cracking along the road.

	**Photo 9.** Inlet to the CNR Trunk down drain – the inlet is partly clogged, and requires maintenance.
	**Photo 10.** Looking up at the CNR retaining wall. There are portions of parging between the piles that has spalled. There isn't evidence that significant soil is being lost from between the piles.

	**Photo 11.** Backscarp of slide in the toe berm in front of the CNR pile wall. The backscarp has not retrogressed significantly since 2008.
	**Photo 12.** Toe of the slope below the CNR pile wall. Significant additional slide movement has occurred, particularly at the south end of the failure. There was an area of active slide movement during the inspection (arrow).

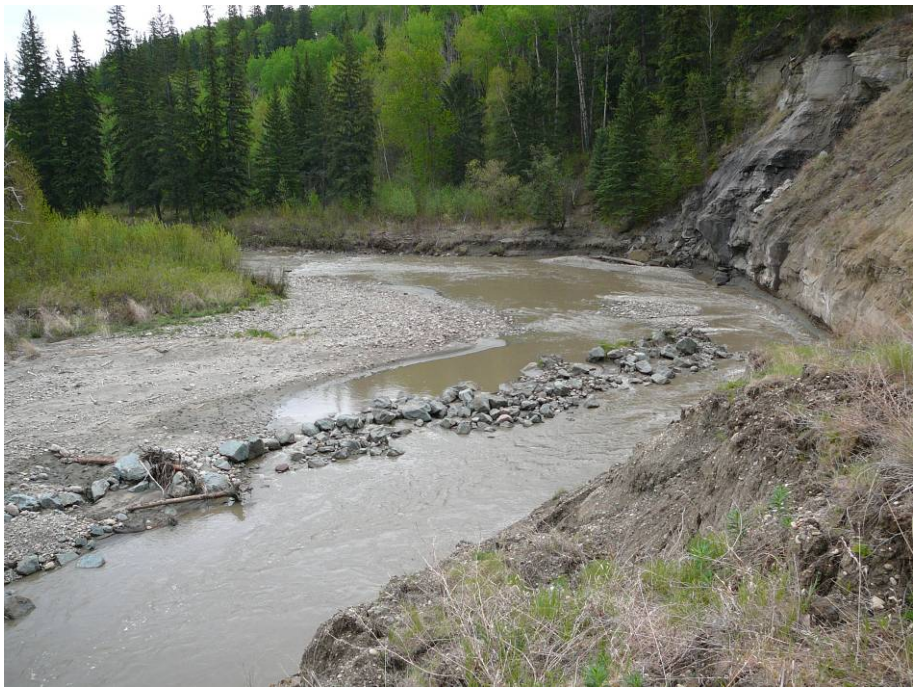


Photo 13.
The Heart River is now flowing entirely on the west side of the channel, having bypassed the rip rap. Erosion is occurring along the toe of the slope, removing debris (foreground) and undercutting the rock slope.

SKIN FAILURE INTO DITCH
– DEBRIS SHOULD BE CLEARED

N

GAS PIPELINE R/W

OLD SLIDE SCARP

CRACKING ALONG SHOULDER
INTO MIDDLE OF LANE AND
LOCALISED DEPRESSION
– MAY HAVE EXTENDED

SI98-1

SI98-6

SI98-7

59.0 km

37° OVERALL
SLOPE

SKIN FAILURE

12 m

SECONDARY ROAD 744

SE 29-83-21-5

SURFACE WATER
EROSION ON ROAD
SHOULDER
(SIGNIFICANT WORSENING
OF EROSION IN 2008)

COUPLING HAS FAILED
– REPAIR REQUIRED

JUDAH TRUNK CULVERT
450 mm CORRUGATED
PLASTIC PIPE
ON SLOPE NOW ALL
JOINTS FAILED

CSP 500mm x 22.04m
OUTLET EL=417.789

CRACKS ACROSS ROAD
CULVERT SOLID
PLASTIC PIPE

DITCH BLOCK

58.9 km

JUDAH TRUNK INLET

SOME DEBRIS CLOGGING INLET
–CLEAR DEBRIS AND IMPROVE INLET

CSP 500mm x 22.04m
INLET EL=419.855

ACCESS TRACK

SOME EROSION UNDER PIPE
UP TO 30 cm DEEP

SURFACE EROSION GULLY
(UP TO 3 m DEEP)

EROSION CONTROL MATTING

SAND AND GRAVEL
DITCH ARMOUR

LEGEND:

SLOPE INDICATOR (ACTIVE)

SLOPE INDICATOR (INACTIVE)

PROPOSED SLOPE INDICATOR

NOTES:

1 LOCATION DATA RECORDED USING HAND HELD GPS RECEIVER. ALL LOCATIONS ARE APPROXIMATE AND ARE FOR ILLUSTRATIVE PURPOSES ONLY.

2 2009 OBSERVATIONS SHOWN IN RED

0 10 20 30 40 50 m

DRAWN BY ICB	DESIGNED BY	APPROVED BY
SCALE 1:750	DATE JULY 3, 2009	FILE No. 15-16-229-A8B

Government of Alberta
Transportation

PEACE REGION (PEACE RIVER/HIGH LEVEL)
PH33 JUDAH HILL - JUDAH TRUNK

SITE PLAN

FIGURE 1

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GEOTECHNICAL • ENVIRONMENTAL • MATERIALS

ONLY MINOR FLOWS

RIP RAP IS PARTLY SUBMERGED BY RIVER BED

CLIFFS

FLOW IS BY-PASSING RIP RAP

FRAC. NE29 83-21-5

HEART RIVER

ACTIVE EROSION AT TOE OF SLOPE

EROSION OF PIPE BASE

MAIN RIVER FLOW NOW ALONG BASE OF SLOPE

BAND COUPLINGS BEGINNING TO FAIL

ACTIVE LANDSLIDE AND TOE EROSION

LEAKAGE FROM JOINT AT BASE OF SLOPE

GAS PIPELINE R/W

CNR TRUNK DOWN PIPE INLET

DEBRIS CLOGGING INLET

FRESH CRACKING

CONTINUED SLIDE MOVEMENT

59.5 km

SECONDARY ROAD 744

EROSION OF ROAD SHOULDER

PROPOSED SLOPE INDICATORS (BETWEEN SLIDE BACKSCARP AND PILE WALL). INSTALL VW PIEZOMETERS AS DETAILED IN REPORT

CEMENT BETWEEN PILES IS SPALLING FRESH SPALLING OF CEMENT BETWEEN PILES

R.L.11

45m TO BACKSCARP

PUMPS (INOPERATIVE)

APPROXIMATE 10m OF PILES EXPOSED AT DOWNSLOPE FACE

DRIVEN STEEL PILES WITH CREOSOTE-TREATED TIMBER LAGGING

59.6 km

RAILWAY TRACKS

CNR TRACK SETTLEMENT

59.7 km

LEGEND:

PROPOSED SLOPE INDICATOR

NOTES:

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2 2009 OBSERVATIONS SHOWN IN RED

0 10 20 30 40 50 m

DRAWN BY	DESIGNED BY	APPROVED BY
ICB		
SCALE 1:1 000	DATE JULY 3, 2009	FILE No. 15-16-229-A8B

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PEACE REGION (PEACE RIVER/HIGH LEVEL)
PH33 JUDAH HILL - CNR SLIDE

SITE PLAN

FIGURE 2

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